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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : B27N 3/08 — A1

(11) International Publication Number: **WO 00/67972**

(43) International Publication Date: 16 November 2000 (16.11.00)

(21) International Application Number: PCT/SE00/00940

(22) International Filing Date: 11 May 2000 (11.05.00)

(30) Priority Data:
9901717-0 11 May 1999 (11.05.99) SE

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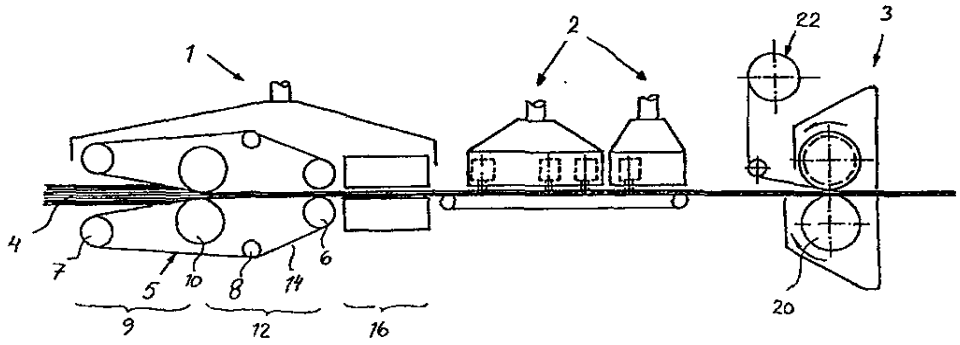
(81) Designated States: AE, AG, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, DZ, EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: METHOD AND ARRANGEMENT FOR THE MANUFACTURE OF LIGNOCELLULOSE-CONTAINING BOARDS



(57) Abstract

The present invention relates to a method of manufacturing boards from lignocellulose-containing material, wherein the material is disintegrated into particles and/or fibres, is dried, glue-coated, and then formed into a mat (4). The mat formed in a first step (1) is compressed into a board that has a generally uniform density, and is pressed in a second step (3; 33) into a finished board. According to the method, the board is subjected between the first step and the second step to an intermediate step (2; 32) in the form of at least one operation of machining by cutting, such as to obtain a pattern on or in the board, while retaining the generally uniform density of the board. The invention also relates to an arrangement for carrying out the method.

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METHOD AND ARRANGEMENT FOR THE MANUFACTURE OF LIGNO-CELLULOSE-CONTAINING BOARDS

The present invention relates to a method of producing boards from lignocellulose-containing material, and to an arrangement for carrying out the method.

Methods of producing boards from lignocellulose-containing raw material are well known to the art and have found wide use in practice. The manufacture of such boards usually includes the following main method steps: disintegration of the raw material into particles and/or fibres of appropriate size, drying the particles and/or fibres to a determined moisture quotient and glue-coating the material either prior to or subsequent to said drying process, shaping the glue-coated material to form a mat, which may comprise several layers, optionally cold-pressing the mat, preheating said mat, water-spraying mat surfaces, etc., and heat-pressing the mat in a discontinuous press or in a continuous press while subjecting the material simultaneously to pressure and heat so as to obtain a finished board. The result will be a board with a sometimes thick surface layer with enhanced surface density.

The boards obtained by this method, e.g. so-called MDF boards (Medium Density Fiberboard) are sometimes used in the production of doors, kitchen cupboard doors, and profiled structural elements such as skirting boards, cornices, window linings, architraving, or furniture components. These structural elements or products are often profiled or patterned, these profiles or patterns being provided in accordance with known technology by milling said profile or pattern in/on the finished board.

This method has many drawbacks. For instance, the method involves a production chain and transport chain that consists of many cost-inducing intermediate steps and operations, and secondly results in a milled product that will normally have different densities in cross-section and therewith absorb different amounts of paint or varnish at different locations, and thirdly milling of the material also results in high material losses. For instance, more than 50% of the starting material can be lost when milling products to pronounced depths.

Because the board has different densities in the two surface layers subsequent to being worked, the board tends to "warp" when subjected to naturally occurring variations in air humidity.

In addition, the known method will normally involve sanding and varnishing, normally with several layers of varnish, or the application of some type of film for priming and/or decorating purposes.

The object of the present invention is to address these problems. Accordingly, the invention relates to a novel method of avoiding the drawbacks associated with the present-day production process and the many intermediate steps, material transportation and other operations in an economic way. The object of the invention is achieved with the method as defined in claim 1 and having the novel characteristic features set forth in the characterising clause of said claim.

Thus, the inventive method is characterized by subjecting a board between a first step, in which the shaped mat is compressed to a board that has an essentially uniform density, and a second step in which the board is pressed to a finished board, to an intermediate step in the form of at least one operation of machining by cutting in order to obtain a pattern on or in said board while retaining the generally uniform density of said board. The present invention thus affords the advantage that the machining operation in which a pattern is cut on or in the board forms part of the production process as an intermediate step prior to finally pressing the board to a finished state. This avoids the expensive transportation and handling operations that are required when the corresponding operation is performed on a finished board.

One important characteristic feature of the board included in the claim is that the board shall have an essentially uniform density both before and after the machining operation, i.e. a so-called straight density profile, which means that the density shall be essentially the same across the full cross-section/thickness of the board. The machining and patterning operation shall thus not result in any appreciable change in the density of the board. This affords the advantage that the material will be the same across the whole board even after having patterned the board, which simplifies and lowers the cost of subsequent operations, such as painting, varnishing or applying a different material to enhance the mechanical

strength of the board or for decoration purposes, among other things. The uniform and unaffected density also has the advantage of reducing the risk of the board warping, by virtue of the fact that the board will absorb moisture uniformly.

Reference is made to Swedish Patents SE 502 272 and SE 504 221 with respect to the manufacture of uniform density board, these patent publications describing methods for obtaining board of uniform density.

Pressing of the board in the second step of the process is carried out in a manner to retain the pattern obtained by the machining operation and may either be performed in a continuous press or in a batch-wise press, so-called discontinuous press, with hot rolls or press plates that include the intended pattern.

The boards is preferably machined in one or more milling operations. Other types of mechanical working of the board, however, are conceivable such as sanding or grinding, for instance. Naturally, a combination of several board machining or working operations may be applied.

According to a first embodiment, the surface layer of the board is modified prior to the second process step but after the machining operation.

According to an alternative embodiment, the surface layer of the board is modified in conjunction with the second step.

Modification of the surface layer of the board may include applying a preglued film to said board or placing a laminate on the board either before pressing the board in the second step or in conjunction therewith, for instance. The film or laminate will then harden firmly to the board, to form a sealing and strengthening layer in the hot pressing operation.

According to another embodiment, a densified surface layer may be produced on the board when pressing said board in the second process step, e.g. in accordance with known technology at high pressures and heat transfer at the beginning of the press cycle.

These embodiments may, of course, be mutually combined in different ways. All embodiments include the possibility of applying a further pattern to the board, such as to give the board a certain surface structure or texture, such as a grain structure or texture.

Examples of methods of providing board with a densified surface layer or a sealing surface layer are described in the aforementioned Swedish patent publications.

The inventive method also has the advantage of enabling material that is cut away by milling or otherwise removed in the machining operation to be returned to the flow of raw material in the board manufacturing process.

Finally, the present invention also relates to a corresponding arrangement for carrying out the method, in accordance with claim 12, comprising an arrangement for carrying out the first step that includes a pre-press in which a mat is compressed to form a board of generally uniform density, and at least one station which includes a cutting machine for carrying out the intermediate step, and further comprising a press for carrying out the second step.

Other features of the present invention and advantages afforded thereby will be apparent from the depending claims.

The present invention will now be described in more detail with reference to two exemplifying embodiments thereof illustrated in the accompanying drawings, in which

Figure 1 is a schematic illustration of plant and a board manufacturing method in accordance with a first embodiment of the present invention in respect of continuous pressing of the board;

Figs. 2a, 2b, 2c show examples of patterns obtained by means of the method and plant illustrated in Fig. 1;

Figure 3 illustrates plant and a method for producing boards in accordance with a second embodiment of the present invention with respect to pressing of the board in a discontinuous press; and

Figs. 4a and 4b show examples of a pattern obtained by milling and stepwise pressing in a discontinuous press (Fig. 4a), and a cross-sectional view of the object in Fig. 4a where the milling operations are illustrated (Fig. 4b).

The process illustrated in Fig. 1 for the manufacture of boards from lignocellulose-containing material, in accordance with a first embodiment, includes a first process stage in the form of a pre-press 1, an intermediate stage that includes

milling stations 2, and a second stage that includes a continuous press 3. Stage one includes a belt press 1, shown in side view, which includes typically drive rolls 6, stretch rolls 7, guide rolls 8 and an adjustable inlet part 9 that includes infeed rolls (not shown), steam roll 10, and a holding section 12 comprising compression roll and further rolls (not shown), and a surrounding wire 14, or alternatively a perforated steel belt with wire. The mat 4 fed into the inlet section 9 is compressed to a predetermined density. The glue hardens/cures in the mat in the holder section 12, such as to obtain board that has a uniform density profile. As an example, the density of the board may be 150-900 kg/m^3, preferably 500-700 kg/m^3. A higher density, in the order of 800-900 kg/m^3, is used in the manufacture of thin boards. In the illustrated case, the holding section 12 is followed by a conditioning unit 16 in which steam and press gases are dealt with.

After having passed through stage one, the compressed mat 4 is fed into board milling stations 2, in which the pattern desired, in the form of surface patterns, profiled strips or the like, are milled in the board.

Subsequent to these milling operations, the board is passed into a continuous press 3, which includes the second process stage. The rolls 20 of this press have the same pattern as the milled pattern, so as to ensure that the milled pattern will not be destroyed as the board is pressed. A sealing surface layer can be obtained on the board beneficially in this way. Alternatively, the surface layer of the board can be further reinforced by applying a pre-glued film or a laminate to the machined board prior to the board entering the second press stage. This alternative is illustrated in Fig. 1 with a laminate feed mill 22. The rolls may have a surface temperature of about between 100 and 300°C, preferably between 150 and 250°C.

Figs. 2a-2c illustrate respective examples of different patterns that can be obtained with the aid of the milling stations in a continuous board pressing process. Figs. 2a and 2b show respective examples of patterns transversely to the longitudinal axis of the board, while Fig. 2c shows an example of a pattern formed in the longitudinal direction of said board. Naturally, many other types of patterns are conceivable within the scope of the invention.

The embodiment illustrated in Fig. 3 is concerned with the manufacture of boards in accordance with the present invention, wherein the second stage is comprised of a discontinuous press in which boards that have been cut to length are pressed batch-wise. Stage 1 is not illustrated in Fig. 3, but may be carried out in the manner illustrated in Fig. 1 or in some other way, for instance in accordance with the aforesaid Swedish patent specifications. The mat 34 compressed to form a board in the first stage is delivered after said stage to a saw 30 that saws the board into board parts of a size suitable for the discontinuous press. After having been sawn to size, the boards are transported to a milling station 32 in which the desired pattern or patterns are milled on the board. Subsequent to the milling process, respective boards are advanced to the discontinuous press 33 and fed thereinto for batch-wise pressing. According to a preferred embodiment of the invention, an surface layer reinforcing laminate is applied to the board prior to said pressing operation. The laminate is delivered from a laminate feed mill 52. The discontinuous press has press plates that include the intended pattern, i.e. the same pattern as that obtained in the milling operations, so that said pattern will be retained as the board is pressed. Optionally, the board may be given a further pattern, for instance in the form of a surface structure. The press plates will preferably have a surface temperature that lies within the same range as that mentioned with respect to the rolls in the first embodiment illustrated in Fig. 1.

Finally, Fig. 4a shows an example of a pattern obtained in the plant illustrated in Fig. 3. The object illustrated may be the door of a kitchen cupboard or cabinet, or a door of some other kind. The door 60 is shown in cross-section in Fig. 4b and in an enlarged view taken on the line A-A in Fig. 4a. In the Fig. 4b illustration, a bevelled surface has been milled on the door around its perimeter edge. The door has also been provided with a grooved profile 62 spaced from said outer edge.

It will be understood that the invention is not restricted to the aforedescribed exemplifying embodiments thereof, and that these embodiments can be modified and varied in many ways by the person skilled in this art, within the scope of the accompanying claims.

CLAIMS

1. A method of manufacturing boards from lignocellulose-containing material in which the material is disintegrated into particles and/or fibres, glue-coated, and formed into a mat, wherein the formed mat is compressed in a first step to provide board of generally uniform density which is then pressed in a second step to form a finished board, **characterized** by subjecting the board between said first step and said second step to an intermediate step in the form of at least one operation of machining by cutting in which a pattern is formed on or in the board while retaining the essentially uniform density of the board.

2. A method according to claim 1, **characterized** by pressing the board in said second step such as to retain the pattern that was produced by machining said board.

3. A method according to any one of the preceding claims, **characterized** in that said board machining operation includes at least one milling operation.

4. A method according to any one of the preceding claims, **characterized** by modifying the surface layer of the board after said intermediate step and before said second step.

5. A method according to any one of the preceding claims, **characterized** by modifying the surface layer of the board in conjunction with said second step.

6. A method according to any one of claims 4-5, **characterized** in that modification of the surface layer of the board includes the accomplishment of a sealing surface layer on said board.

7. A method according to any one of claims 4-6, **characterized** in that modification of the surface layer of said board includes applying a pre-glued film to said board.

8. A method according to any one of claims 4-6, **characterized** in that modification of the surface layer of said board includes applying a laminate to said board.

9. A method according to any one of the preceding claims, **characterized** by forming a further pattern on the board prior to or in conjunction with said second step.

10. A method according to any one of the preceding claims, **characterized** by densifying the surface layer of the board when pressing said board in the second step.

11. A method according to any one of the preceding claims, **characterized** by returning at least part of the material removed during said machining operation back to the inflow of raw material to the board manufacturing process.

12. An arrangement for carrying out the method according to any one of claims 1-11, comprising an arrangement for carrying out the first step of said method and including a pre-press (1) in which a mat is compressed into a board that has a generally uniform density, at least one station that includes a cutting machine (2; 32) for carrying out the intermediate step of said method, and a press (3; 33) for carrying out the second step of said method.

13. An arrangement according to claim 12, **characterized** in that the cutting machine in said station includes at least one milling machine (2; 32).

14. An arrangement according to any one of claims 12-13, **characterized** by an arrangement (22; 52) for modifying the surface layer of the board subsequent to said intermediate step.

15. An arrangement according to claim 14, **characterized** in that the arrangement (22; 52) for modifying the surface layer of the board after said intermediate step includes means for applying reinforcing and/or sealing material to said board.

16. An arrangement according to any one of claims 12-15, **characterized** in that the press for carrying out the second step of the method is a continuous press (3) whose press elements in contact with the board are provided with the same pattern as that produced in the intermediate step.

17. An arrangement according to any one of claims 12-15, **characterized** in that it also includes means (30) for cutting the board into lengths; and in that the press for carrying out the second step of the method is a discontinuous press (33) whose press elements in contact with the board are provided with the same pattern as that produced in the intermediate step of said method.

18. An arrangement according to any one of claims 12-17, **characterized** in that the press (3; 33) for carrying out the second step of the method also includes means for densifying the surface layer of the board.

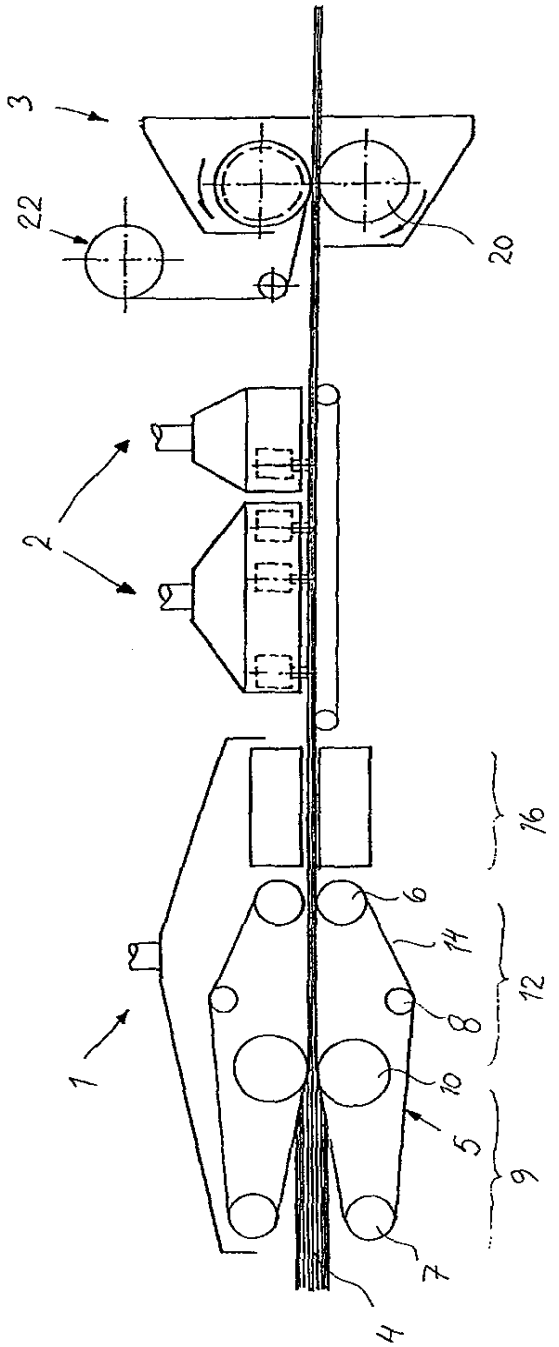

Fig. 1

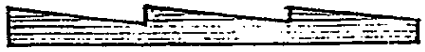

Fig. 2 a

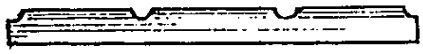

Fig. 2 b

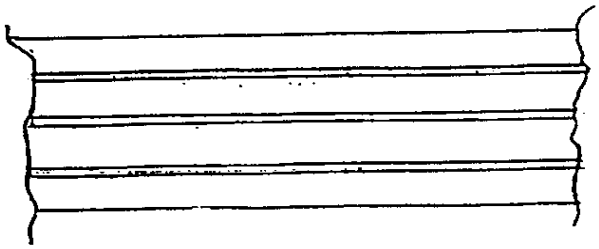

Fig. 2 c

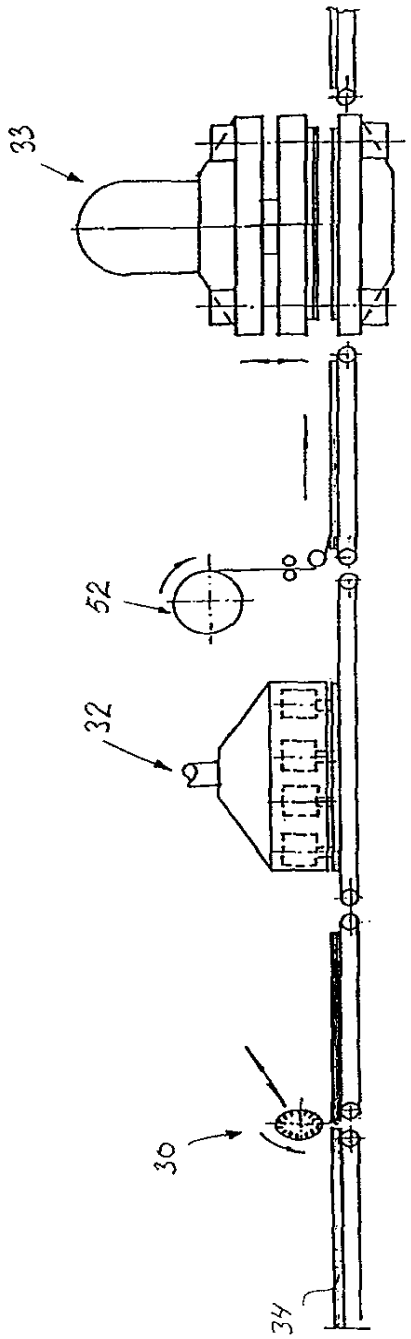

Fig. 3

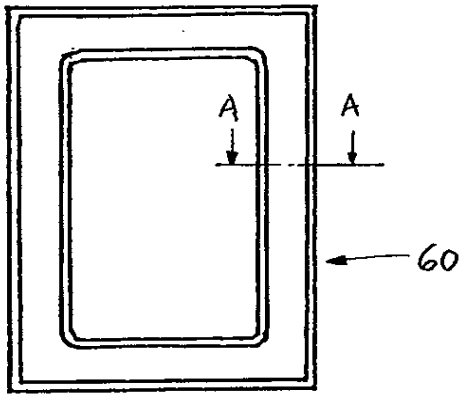

Fig. 4 a

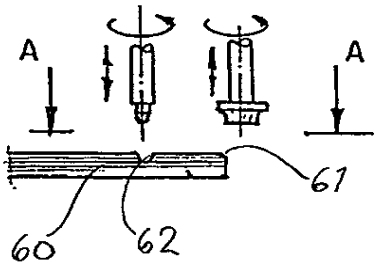

Fig. 4 b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/00940

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B27N 3/08
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B27N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG: ALLSCIENCE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9631327 A1 (SUNDS DEFIBRATOR INDUSTRIES AB), 10 October 1996 (10.10.96) --	1,12
A	WO 9520473 A1 (SUNDS DEFIBRATOR INDUSTRIES AB), 3 August 1995 (03.08.95) --	1,12

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Information on patent family members

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International application No.
PCT/SE 00/00940

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